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ABSTRACT

The Transportation Engineering Education and Outreach Program was organized to develop and disseminate educational and outreach materials that would encourage students in colleges, universities, and technical schools to select transportation as a career path and to attract more students into transportation graduate programs. The research capitalized on the transportation expertise of the Texas Transportation Institute as well as on its relationship with other regional universities. Materials developed under this program included speaker notes, visual aids, reference materials, interactive demonstrations, and computer exercises that utilize transportation-related Internet sites; the purpose was to expose university and technical school students to the transportation profession and the role it plays in urban, suburban, and rural mobility. The materials also provide insight into the broad range of employment opportunities available within the profession and the manner in which technology is applied to transportation. The document includes an introduction, which provides background materials; a section covering development of two modules--one on the transportation profession and another on intelligent transportation systems; a discussion of the outreach and technology transfer activities; a section on program assessment; and recommendations. A copy of the transportation profession module is appended, as well as project feedback forms. (CH)

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Southwest Region University Transportation Center

Transportation Engineering Education and Outreach Program Designed for the Collegiate Level

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Texas Transportation Institute
Texas A&M University System
College Station, Texas 77843-3135

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16. Abstract

The past decade has seen revolutionary changes in the face of transportation in the United States. With the deployment of Intelligent Transportation Systems (ITS) and the monumental leaps made in technology applications in all aspects of life, the transportation profession is faced with a new dilemma. In short, the current and future success of the transportation infrastructure and its diverse array of components depend on developing a larger cadre of transportation professionals capable of designing, planning, managing, operating, and maintaining it. Furthermore, overall awareness of transportation by the general public is necessary to ensure political, community, and financial support of future transportation projects. The next generation of transportation professionals will come from current and future groups of undergraduate, graduate students, and vocational and technical school students. Thus, it is critical that universities take a proactive role in educating and preparing future transportation professionals to work effectively and efficiently in the 21st century. This paradigm shift is necessary to ensure that the transportation profession attracts qualified individuals who can work within an ever-changing and ever-advancing technological future. In turn, these professionals can work to ensure that the transportation infrastructure is maintained and improved so that it sustains the mobility necessary to enhance the nation's economic strength. The purpose of this research was to capitalize on both the transportation expertise of the Texas Transportation Institute (TTI) as well as its relationship with other universities within the region. The objective was to develop and disseminate educational and outreach materials that encourage students in colleges, universities, and technical schools to select transportation as their career path and attract more students into transportation graduate programs. Target students were not limited to civil engineering programs, but were in any discipline with direct links to the transportation industry. Once developed, various components of the program appropriate for electronic distribution were made accessible to educators, students, and the general public via the Internet.

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TRANSPORTATION ENGINEERING EDUCATION AND OUTREACH PROGRAM DESIGNED FOR THE COLLEGIATE LEVEL

Final Report

By

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September 1999

ABSTRACT

The past decade has seen revolutionary changes in the face of transportation in the United States. With the deployment of Intelligent Transportation Systems (ITS) and the monumental leaps made in technology applications in all aspects of life, the transportation profession is faced with a new dilemma. In short, the current and future success of the transportation infrastructure and its diverse array of components depend on developing a larger cadre of transportation professionals capable of designing, planning, managing, operating, and maintaining it. Furthermore, overall awareness of transportation by the general public is necessary to ensure political, community, and financial support of future transportation projects. The next generation of transportation professionals will come from current and future groups of undergraduate, graduate students, and vocational and technical school students. Thus, it is critical that universities take a proactive role in educating and preparing future transportation professionals to work effectively and efficiently in the 21st century. This paradigm shift is necessary to ensure that the transportation profession attracts qualified individuals who can work within an ever-changing and ever-advancing technological future. In turn, these professionals can work to ensure that the transportation infrastructure is maintained and improved so that it sustains the mobility necessary to enhance the nation's economic strength. The purpose of this research was to capitalize on both the transportation expertise of the Texas Transportation Institute (TTI) as well as its relationship with other universities within the region. The objective was to develop and disseminate educational and outreach materials that encourage students in colleges, universities, and technical schools to select transportation as their career path and attract more students into transportation graduate programs. Target students were not limited to civil engineering programs, but were in any discipline with direct links to the transportation industry. Once developed, various components of the program appropriate for electronic distribution were made accessible to educators, students, and the general public via the Internet.

ACKNOWLEDGEMENTS

The author recognizes that support was provided by a grant from the U.S. Department of Transportation, University Transportation Centers Program to the Southwest University Transportation Center. The author would like to thank the following individuals, without whose assistance this undertaking would not have been possible: John Chivvas, Debbie Jasek, and Laura Wright of TTI College Station; Robert Brydia of TransLink® Research Center; Cesar Quiroga of TTI San Antonio; David Fenno and Anthony Voigt of TTI Houston; and Naomi Ledé of TTI.

The study team wishes to acknowledge the cooperation and input of the various universities and organizations that provided venues for project activities, including Texas A&M University, University of Texas, San Antonio, Prairie View A&M University, and Texas Southern University. Their input was critical to the success of this project and their assistance was appreciated.

DISCLAIMER

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EXECUTIVE SUMMARY

The past decade has seen revolutionary changes in the face of transportation in the United States. With the deployment of Intelligent Transportation Systems (ITS) and the monumental leaps made in technology applications in all aspects of life, the transportation profession is faced with a new dilemma. In short, the current and future success of the transportation infrastructure and its diverse array of components depend on developing a larger cadre of transportation professionals capable of designing, planning, managing, operating, and maintaining it. Furthermore, overall awareness of transportation by the general public is necessary to ensure political, community, and financial support of future transportation projects.

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With this project, educational and outreach materials were developed based on Texas Transportation Institute's storehouse of transportation knowledge. The materials developed included speaker notes, visual aids, reference materials, interactive demonstrations, and computer exercises that utilize transportation-related Internet sites. The purpose of these materials was to expose university and technical school students to the transportation profession and the role it plays in urban, suburban, and rural mobility. They also provided insight into the broad range of employment opportunities available within the profession and the manner in which technology is be applied to transportation. The project team developed an educational module on the transportation profession. The module provides general information on transportation, its various facets, and its viability as a career option. The target audience for the module, which

consist of a Microsoft PowerPoint presentation and speaker notes, is college students and the general public. The project team also made available the education module entitled "Intelligent Transportation Systems." This module, developed under another project sponsored by the Texas A&M University ITS Research Center of Excellence, has as its objective to provide information on the importance of ITS on the transportation industry of the future. The target audience for this module is college students and the general public. The module – consisting of presentation slides, lecture notes, and exercises - can easily be incorporated into any undergraduate engineering program, transportation or otherwise, to increase ITS awareness and to encourage students to pursue transportation and ITS as a career. Furthermore, the material can be used in non-engineering arenas to increase awareness of transportation as a viable career choice for the wide variety of individuals with technical backgrounds necessary to operate and maintain the complex technologies being used in our cities to make transportation more safe and efficiently.

Upon completion of material development and throughout the project, staff from TTI teamed with other universities and college to deliver educational materials and information to students across Texas. This outreach included staff serving as guest speakers during class lectures or with student organizations, tours of the TTI facilities and laboratories, staff serving as instructors for college courses, and distribution of materials via various methods. Pre-established relationships with Texas Southern University, Prairie View A&M University, and University of Texas, San Antonio provided a test bed for these activities to assess needs and potential success.

While most of the outreach and technology activities undertaken during the course of the project took place in the SWUTC region, the materials developed as a result of the project can be used nationwide. The location of materials on the Center for Professional Development's Internet site, http://tti.tamu.edu/inside/centers/cpd, enhances widespread distribution and use of the materials for a variety of audiences. Furthermore, mechanisms will soon be in place to provide feedback regarding the content of the materials and to facilitate easy delivery via traditional and non-traditional mechanisms. An outgrowth of this project will also be a TTI Speaker Directory so that those groups needing speakers or presentations on transportation-related topics can tap into the expertise within the Institute.

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1. INTRODUCTION

The past decade has seen revolutionary changes in the face of transportation in the United States. With the deployment of Intelligent Transportation Systems (ITS) and the monumental leaps made in technology applications in all aspects of life, the transportation profession is faced with a new dilemma. In short, the current and future success of the transportation infrastructure and its diverse array of components depend on developing a larger cadre of transportation professionals capable of designing, planning, managing, operating, and maintaining it. Furthermore, overall awareness of transportation by the general public is necessary to ensure political, community, and financial support of future transportation projects.

1.1 BACKGROUND

The next generation of transportation professionals will come from current and future groups of undergraduate, graduate students, and vocational and technical school students. Thus, it is critical that universities take a proactive role in educating and preparing future transportation professionals to work effectively and efficiently in the 21st century. This paradigm shift is necessary to ensure that the transportation profession attracts qualified individuals who can work within an ever-changing and ever-advancing technological future. In turn, these professionals can work to ensure that the transportation infrastructure is maintained and improved so that it sustains the mobility necessary to enhance the nation's economic strength.

1.2 PURPOSE

The purpose of this research was to capitalize on both the transportation expertise of the Texas Transportation Institute (TTI) as well as its relationship with other universities within the region. The objective was to develop and disseminate educational and outreach materials that encourage students in colleges, universities, and technical schools to select transportation as their career path and attract more students into transportation graduate programs. Target students were

not limited to civil engineering programs, but were in any discipline with direct links to the transportation industry. Once developed, various components of the program appropriate for electronic distribution were made accessible to educators, students, and the general public via the Internet.

2. DEVELOPMENT OF MATERIALS

With this project, educational and outreach materials were developed based on Texas Transportation Institute's storehouse of transportation knowledge. The materials developed included speaker notes, visual aids, reference materials, interactive demonstrations, and computer exercises that utilize transportation-related Internet sites. The purpose of these materials was to expose university and technical school students to the transportation profession and the role it plays in urban, suburban, and rural mobility. They also provided insight into the broad range of employment opportunities available within the profession and the manner in which technology is be applied to transportation. The following sections provide a description of the materials developed under this task of the project.

2.1 "THE TRANSPORTATION PROFESSION" MODULE

The project team developed an educational module on the transportation profession. The module provides general information on transportation, its various facets, and its viability as a career option. The target audience for the module, which consist of a Microsoft PowerPoint presentation and speaker notes, is college students and the general public. A copy of the module, complete with slides and speaker notes, is located in Appendix A.

An electronic version of the module is posted on the Center for Professional Development's Internet site to facilitate easy access by educators and others. The URL for the site is http://tti.tamu.edu/inside/centers/cpd. The module was posted with other educational resources on the site and visitors can download the module directly. A form is posted along with the module to track access and usage. Information requested of a user includes contact information and the intended use of the module.

2.2 "INTELLIGENT TRANSPORTATION SYSTEMS" MODULE

The project team made available the education module entitled "Intelligent Transportation Systems." This module, developed under another project sponsored by the Texas A&M University ITS Research Center of Excellence, has as its objective to provide information on the importance of ITS on the transportation industry of the future. The target audience for this module is college students and the general public. The module – consisting of presentation slides, lecture notes, and exercises - can easily be incorporated into any undergraduate engineering program, transportation or otherwise, to increase ITS awareness and to encourage students to pursue transportation and ITS as a career. Furthermore, the material can be used in non-engineering arenas to increase awareness of transportation as a viable career choice for the wide variety of individuals with technical backgrounds necessary to operate and maintain the complex technologies being used in our cities to make transportation more safe and efficiently.

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3. OUTREACH AND TECHNOLOGY TRANSFER

Upon completion of material development and throughout the project, staff from TTI teamed with other universities and college to deliver educational materials and information to students across Texas. This outreach included staff serving as guest speakers during class lectures or with student organizations, tours of the TTI facilities and laboratories, staff serving as instructors for college courses, and distribution of materials via various methods. Pre-established relationships with Texas Southern University, Prairie View A&M University, and University of Texas, San Antonio provided a test bed for these activities to assess needs and potential success.

3.1 EDUCATION AND OUTREACH

Several educational and outreach activities occurred during the course of the project. TTI staff participated in the various college-level efforts that are listed in Table 1. Materials developed as part of this project were used in some of these presentations. It is intended that in the near future portions of materials specifically developed for the college courses, that are appropriate for widespread use, will be posted on the Center's Internet site for electronic access.

Table 1. Education and Outreach Activities

Course	Location	Event	No. of Students & Level
Transportation Engineering	Texas A&M University College Station, Texas	Provided a tour of the TransLink® Laboratory and discussion on ITS.	28 Students College Juniors
Pavement Management Systems	University of Texas, San Antonio San Antonio, Texas	Presentation on applications of GPS and GIS to transportation.	6 Students Graduate Students
Transportation Engineering and Planning	Prairie View A&M University Prairie View, Texas	Taught the course for Spring 1999 Semester.	14 Students College Seniors
Principles of Transportation Design and Engineering	Texas Southern University Houston, Texas	Taught the course for the Spring 1999 Semester	5 Students Graduate Students
Transportation Systems	University of Texas, San Antonio San Antonio, Texas	Taught the course for the Spring 1999 Semester	20 Students College Students

3.2 TECHNOLOGY TRANSFER

For outreach activities to be successful, education materials must be disseminated to transportation professionals and educators who will use them appropriately. During the course of this project, technology transfer took place through the physical and electronic distribution of modules to those who might use them in educational and outreach activities. As noted previously, distribution via the Internet is monitored through the use of on-line forms completed by those accessing the files. Table 2 provides a summary of the distribution of the two educational modules developed and made accessible as a result of this project.

Table 2. Distribution of Educational Modules

Module	Number Distributed	Recipient	Method of Delivery
Intelligent Transportation Systems Module	7	TTI Offices	Surface Mail
	7	DART Community Affairs Office	Hand Delivery
	7	FHWA – R&D Dowling College UC-Irvine PBS&J Harris County Mitrerek Systems	Electronic Download
The Transportation Profession Module	7	TTI Offices	Surface Mail
	7	DART Community Affairs Office	Hand Delivery
	5	Dowling College UC-Irvine Volpe Mitretek Systems McGlothin Davis, Inc.	Electronic Download

4. PROGRAM ASSESSMENT

A key component of this education and outreach project was to determine whether the information developed and presented was appropriate for the intended audience. Furthermore, it was important to clarify whether objectives were met and what, if anything, can be done to improve and enhance the program. The following sections describe the assessment of the program undertaken by the project team.

4.1 FEEDBACK

One way in which the program was assessed was through the use of After Event Reports and Event Feedback Reports. Each TTI staff member who participated in an outreach effort was asked to complete an After Event Report to provide specific information about the activity and whether the event was well received by the students and educator(s) associated with the audience. Copies of these forms are included in Appendix B.

For the education and outreach activities that were undertaken and reported by TTI staff, the students appeared to find the presentations interesting and interacted with the instructors on a positive level. In most cases, the students and instructor asked questions and participated actively throughout the presentation. With respect to feedback from faculty contacts, instructors found the presentations interesting and informative to their students. They indicated that the information presented was at an appropriate level for them, and they expressed an interest in continuing the presentations and gaining access to a list of speakers and topics available for presentation from TTI. Therefore, according the feedback received during the project, the materials developed are at an appropriate level for college students and they are adequately providing outreach and educational information regarding the transportation industry and its potential for career opportunities.

4.2 INTENDED USE

As noted by Table 2 in the previous section, various individuals and organizations gained access to the educational modules developed as part of this project. Based on information provided by those accessing the information electronically, the intended use of these materials was varied. For example, the federal employees accessing the modules were mostly interested in reviewing the materials for awareness and consistency. Some individuals wanted the materials for personal study in conjunction with college courses. Still others intended to use the modules as course materials for college courses, and others wanted them for internal education programs. Thus, based on these responses, the outreach objectives of the project were met. Furthermore, it is intended that the delivery of these modules will continue as more individuals learn about their existence.

4.3 CONTINUED IMPROVEMENT

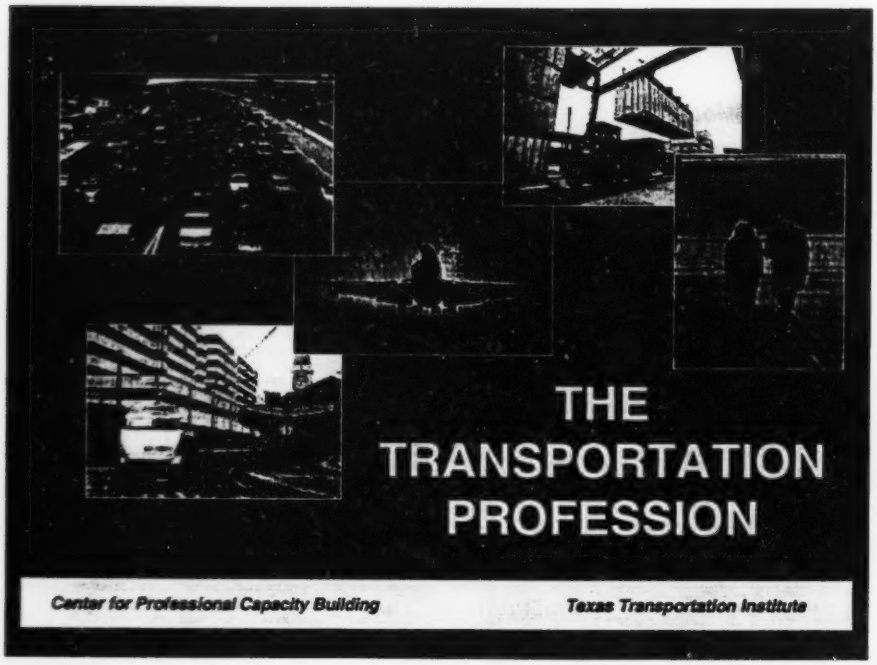
It is hoped that as TTI staff and other professionals use the materials, they will provide feedback and suggestions for improving the resources so as to maximize the impact of their use with audiences of all appropriate ages. To facilitate this feedback, a form will be posted on the Center's Internet site in the near future and included in materials mailed to users for their use. In addition, it is anticipated that a directory will be compiled of TTI staff willing to provide lectures or presentations on various transportation-related topics. This directory would be made available on the Center's Internet site to facilitate access by educators and professionals with Texas and across the country.

5. RECOMMENDATIONS

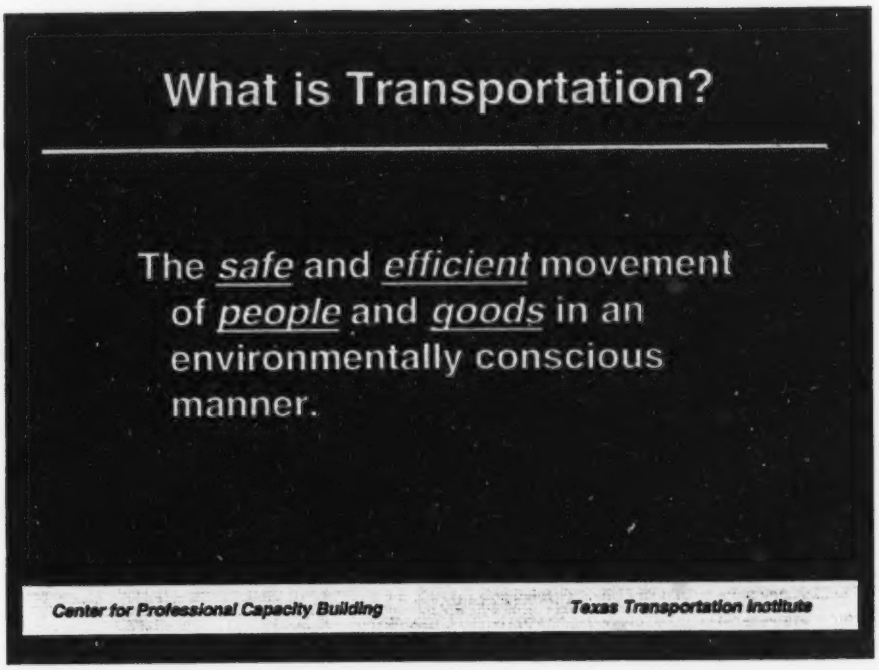
The results presented in this report begin to develop a program for exposing college students to transportation engineering and encouraging them to pursue careers in the transportation profession. While most of the outreach and technology activities undertaken during the course of the project took place in the SWUTC region, the materials developed as a result of the project can be used nationwide. The location of materials on the Center for Professional Development's Internet site, http://tti.tamu.edu/inside/centers/cpd, enhances widespread distribution and use of the materials for a variety of audiences. Furthermore, mechanisms will soon be in place to provide feedback regarding the content of the materials and to facilitate easy delivery via traditional and non-traditional mechanisms. An outgrowth of this project will also be a TTI Speaker Directory so that those groups needing speakers or presentations on transportation-related topics can tap into the expertise within the Institute. Finally, it is important to recognize that this program works to meet the goals and objectives of SWUTC and the national Professional Capacity Building program, especially as it relates to educating the future professionals that will design, build, operate, manage, and maintain the transportation infrastructure of the 21st century.

APPENDICES

APPENDIX A: "THE TRANSPORTATION PROFESSION" MODULE



Slide 1 - The Transportation Profession


What is Transportation?
The safe and efficient movement of people and goods in an environmentally conscious manner.
Center for Professional Capacity Building
Texas Transportation Institute

Slide 2 - What is Transportation?

The safe and efficient movement of people and goods in an environmentally conscious manner.

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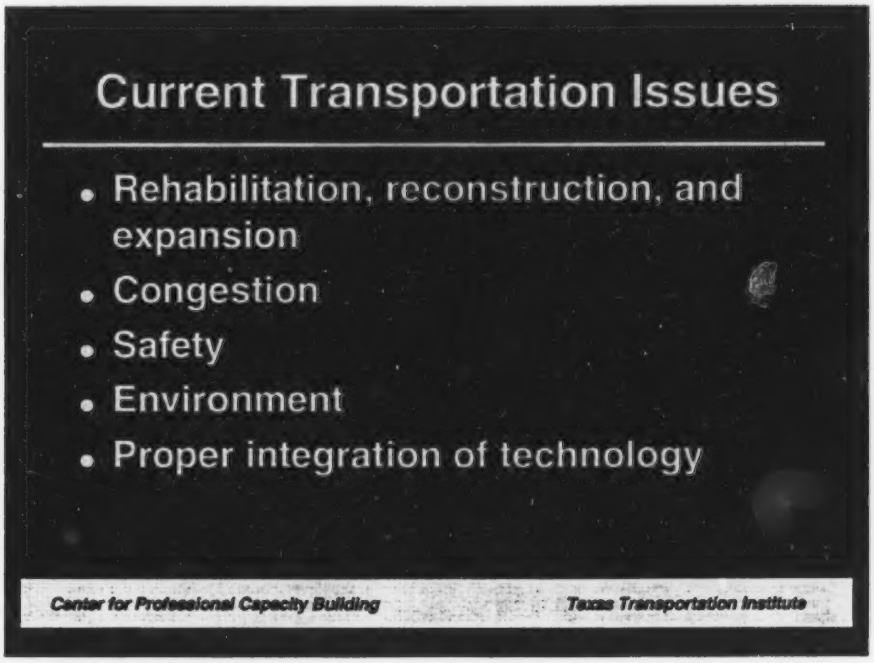

Slide 3 - Current Transportation Issues

•Rehabilitation, reconstruction, expansion

- *•crumbling infrastructure - provides opportunity to redesign older facilities to meet today's demands*
- *•legislation - ISTEA, CAAA, TEA-21 limit funds and provide a new direction and emphasis*
- *•added responsibilities - cost effective and environmentally sound*

•Congestion

- *•all modes, especially surface and air*

•Safety

- *•continue to make overall safety improvements to the system*

•Environment

- *•air quality, water quality*

•Proper integration of technology

- *•ITS*
- *•air traffic control*

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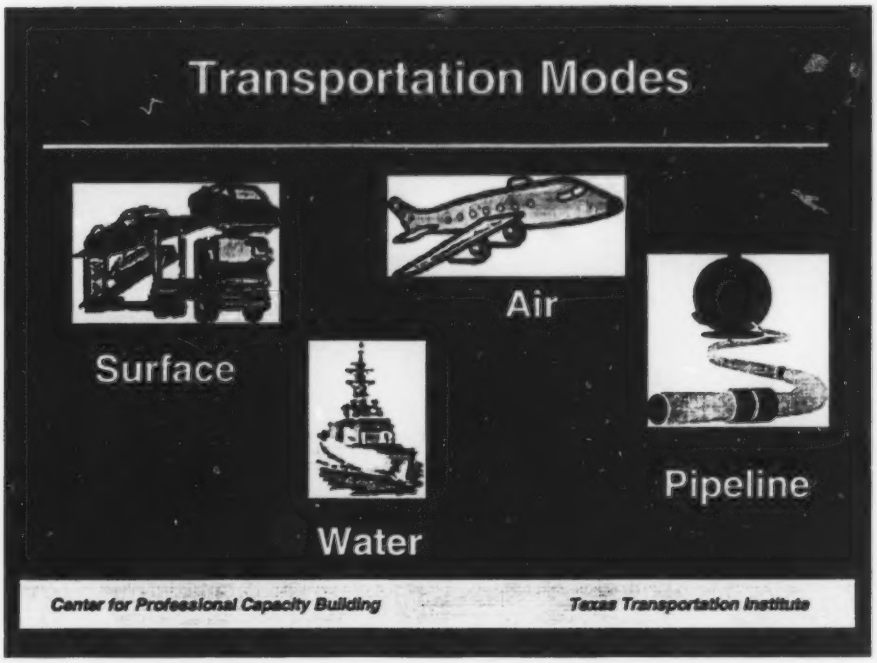
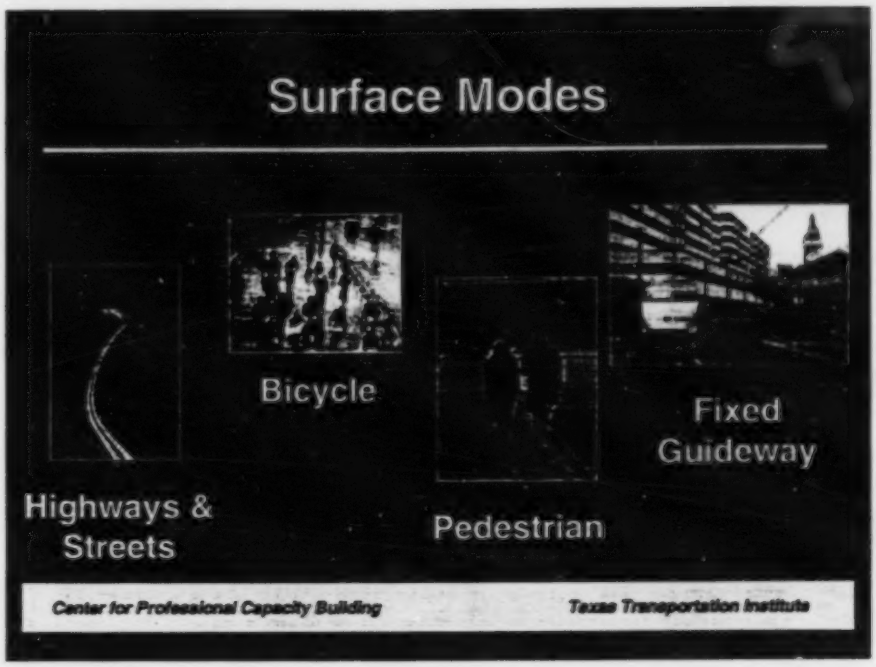


Slide 4 - Transportation Modes

- Surface
- Air
- Water
- Pipeline

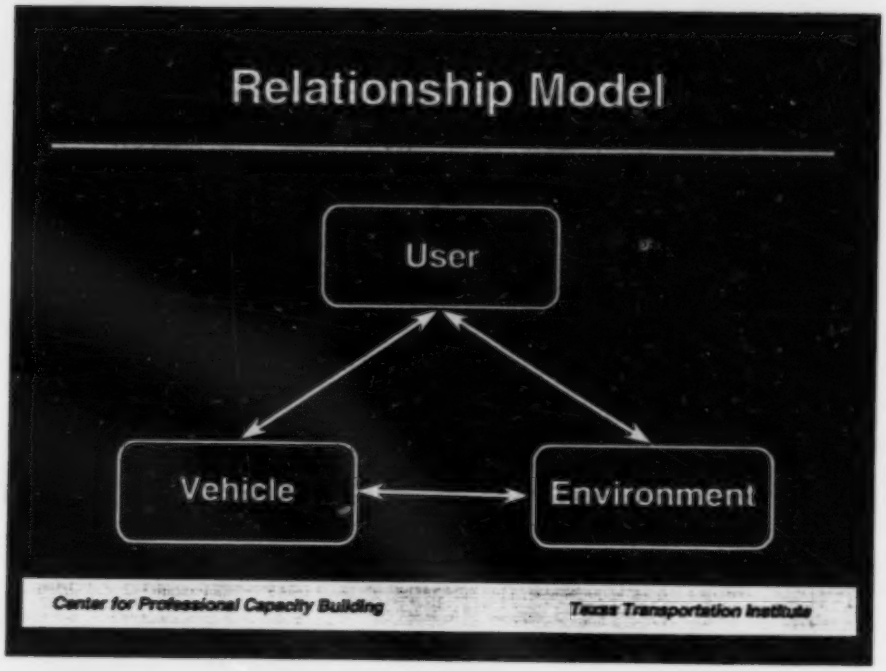
These are the primary modes of transportation.



Slide 5 - Surface Modes

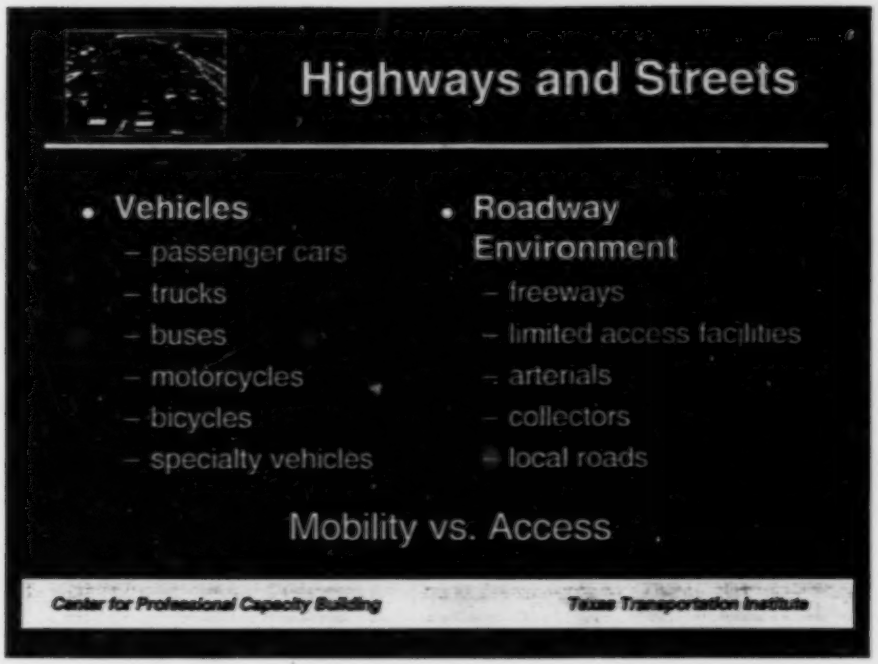
- Highways and Streets
- Fixed Guideway
- Bicycle
- Pedestrian

These are the different modes within the surface transportation category.



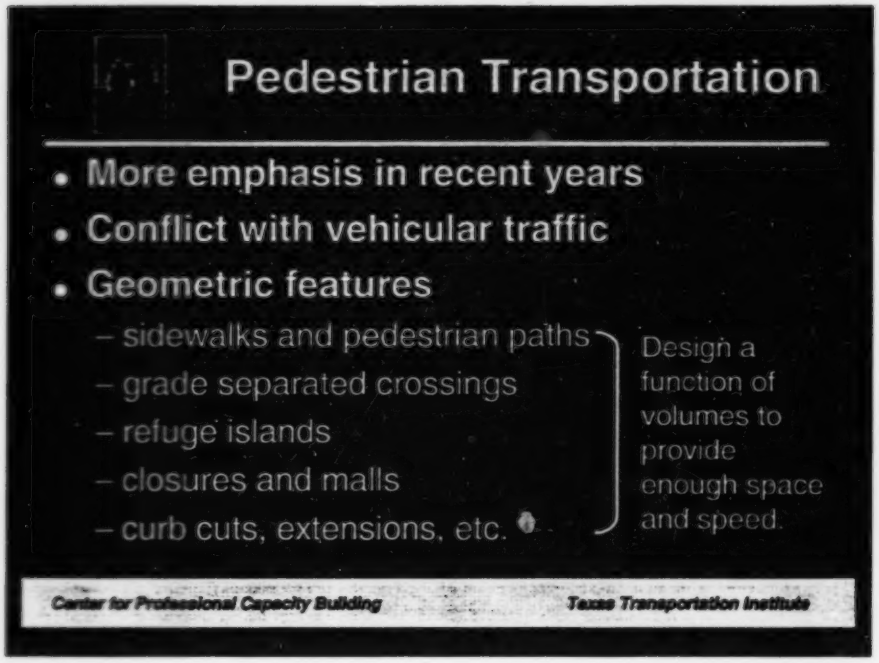
Slide 6 - Relationship Model

These three components of a transportation system have an interconnected relationship. The engineer can design the environment and the vehicle, but he/she has little affect on the behavior of the user.



Slide 7 - Highways and Streets

- Vehicles
  - passenger cars (SOV and HOV)
  - trucks *(SU, combination units, doubles, triples)*
  - buses *(transit, school, intercity)*
  - motorcycles
  - bicycles
  - specialty vehicles *(emergency vehicles, recreational vehicles)*
- Roadway Environment
  - freeways
  - limited access facilities
  - arterials
  - collectors
  - local roads
- Strike a Balance between Mobility and Access

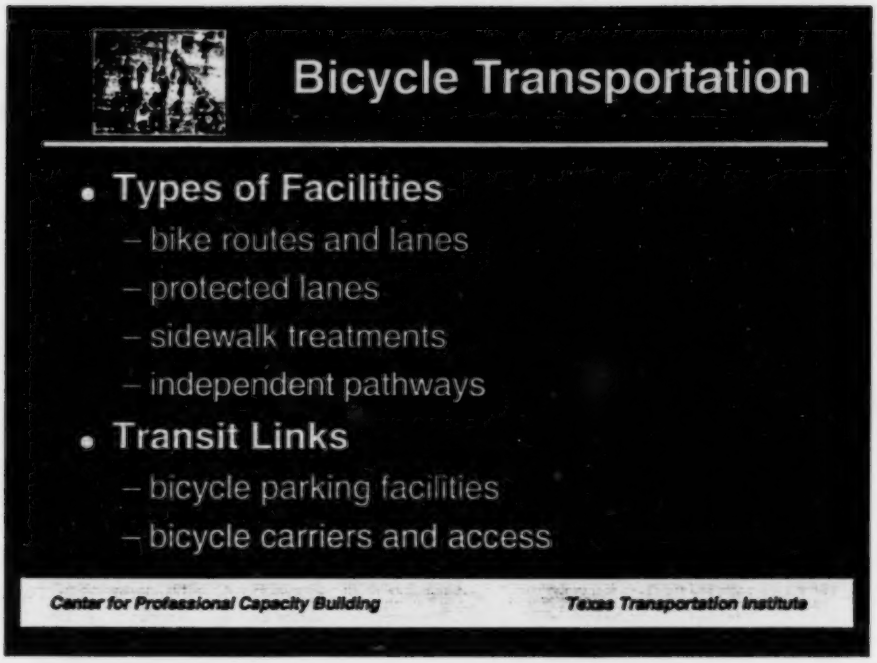

Pedestrian Transportation
• More emphasis in recent years
• Conflict with vehicular traffic
• Geometric features
– sidewalks and pedestrian paths
– grade separated crossings
– refuge islands
– closures and malls
– curb cuts, extensions, etc.
Design a function of volumes to provide enough space and speed.
Center for Professional Capacity Building
Texas Transportation Institute

Slide 8 - Pedestrian Transportation

- More emphasis in recent years
- Conflict with vehicular traffic
- Geometric features
    - sidewalks and pedestrian paths
    - grade separated crossings *(overpasses)*
    - refuge islands *(intersections/streets)*
    - closures and malls
    - curb cuts, extensions, etc. *(wheelchairs, widened or paved shoulders)*

- *Design of pedestrian facilities is dependent on the volume of pedestrians in order to provide enough space and walking speed.*

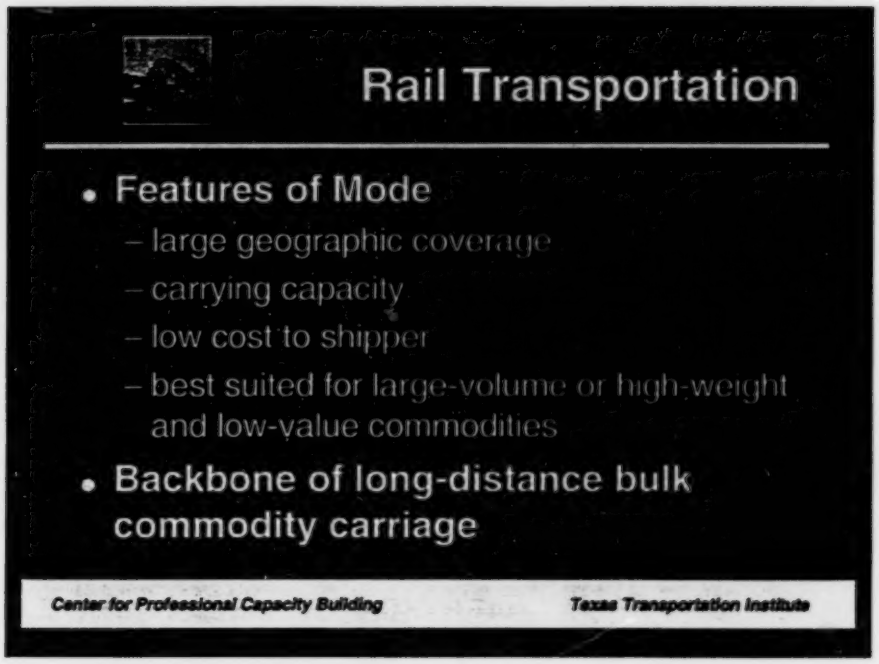
- *Walking speed is a function of age, gender, volume, grade, width of walking space, proximity to oncoming vehicles, and type of pedestrians.*



Slide 9 - Bicycle Transportation

Types of Facilities
- •bike routes and lanes
- •protected lanes
- •sidewalk treatments
- •independent pathways

•Transit Links
- •bicycle parking facilities *(Seattle, Ontario)*
- •bicycle carriers and access *(eg.,in Dallas, bikes may be brought onto the light rail cars during off-peak hours)*


Rail Transportation
• Features of Mode
– large geographic coverage
– carrying capacity
– low cost to shipper
– best suited for large-volume or high-weight and low-value commodities
• Backbone of long-distance bulk commodity carriage
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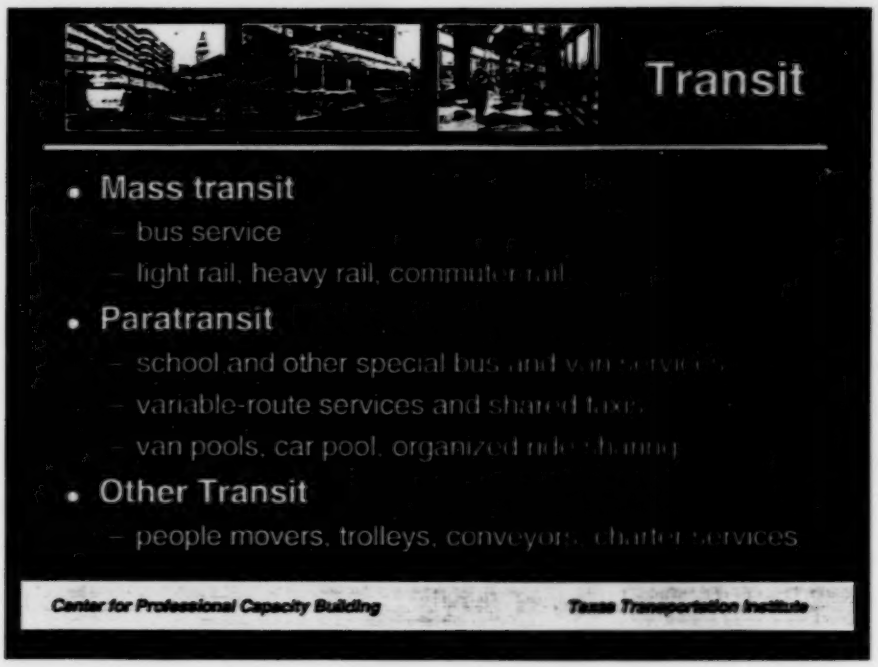
Slide 10 - Rail and Fixed Guideway

- Features of Mode
  - large geographic coverage
  - carrying capacity
  - low cost to shipper
  - best suited for large-volume or high-weight and low-value commodities
    - *coal, grain, oil and chemical products, pulp and paper products, forest products, and manufactured products such as vehicles, machinery, parts, and equipment*
- High Fixed Costs
  - right-of-way, terminals, rolling stock
- Low Variable Costs
  - fuel, insurance, taxes, equipment, maintenance
- Critical to intermodal transportation
- Backbone of long-distance bulk commodity carriage


Transit
• Mass transit
– bus service
– light rail, heavy rail, commuter rail
• Paratransit
– school and other special bus and van services
– variable-route services and shared taxis
– van pools, car pool, organized ride sharing
• Other Transit
– people movers, trolleys, conveyors, charter services
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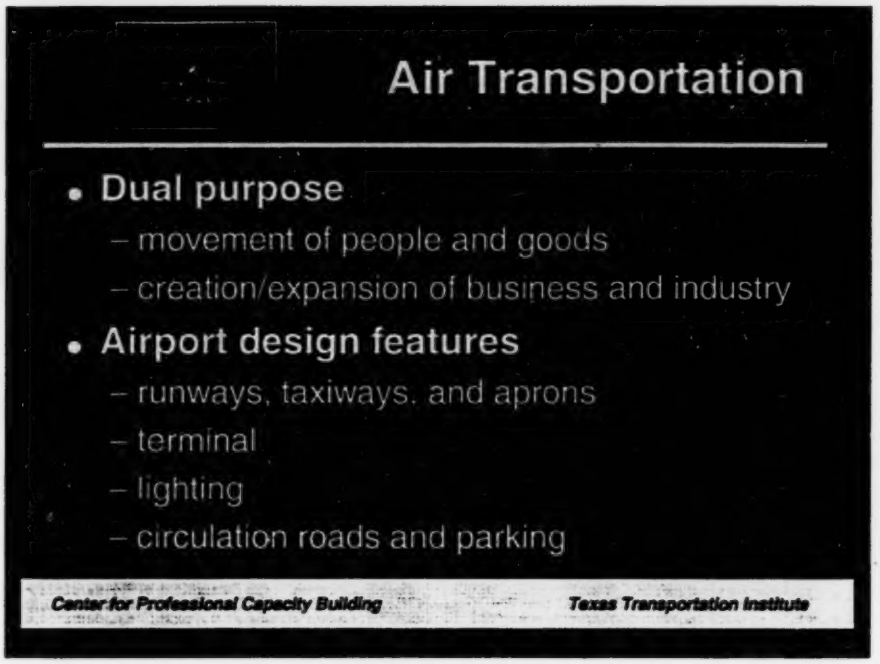
Slide 11 - Transit

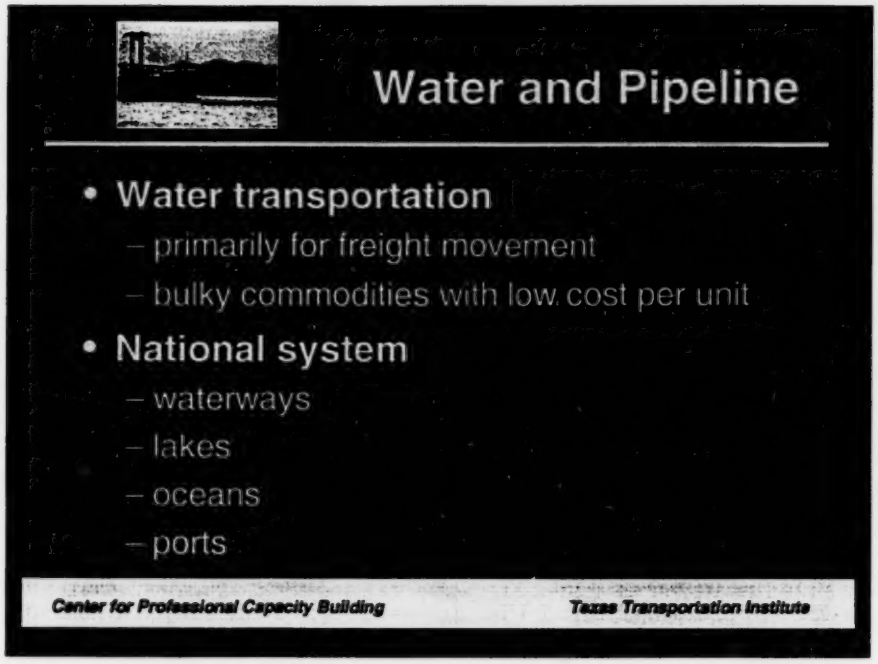
- Mass transit
  - bus service
  - light rail
    - *rail service at least partly on shared or semi-exclusive ROW, designed so that other traffic can mingle with LRT operation safely*
  - heavy rail
    - *rail service on exclusive ROW, designed without need to accommodate any other type of transit*
    - *at-grade, elevated, underground*
  - commuter rail
- Paratransit
  - complements conventional transit and meets the needs of special travelers and groups
  - school and other special bus and van services
    - *social health, subscription buses, community and neighborhood services*
  - variable-route services and shared taxis
  - van pools, car pool, organized ride sharing
- Other Transit
  - people movers, trolleys, conveyors, charter services, intercity services



Slide 12 - Air Transportation

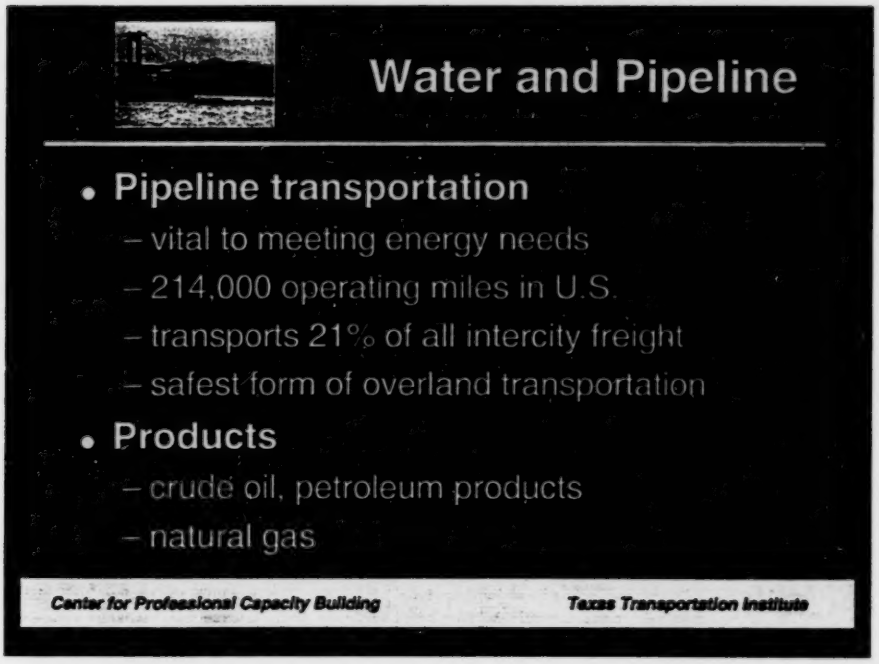
Dual purpose
- movement of people and goods
- creation/expansion of business and industry

- Airport design features
  - runways, taxiways, and aprons
    - *runway lengths*
    - *runway numbering system*
    - *runway layout*
    - *wind coverage*
    - *taxiways and holding aprons*
  - terminal
  - airport lighting
    - *beacon, obstruction lights, wind indicator, runway lights, threshold lights, taxiway lights, taxiway guidance signs, in-runway lights, approach-light systems, runway-end identifier lights, visual-approach slope indicator, instrument landing system*
  - circulation roads and parking



Slide 13 - Water and Pipeline

- Water transportation
  - primarily for freight movement
  - bulky commodities with low cost per unit
    - *bituminous coal and lignite (approximately 25% of tonnage)*
    - *general cargo (hardware, electrical goods, fabrics, etc.)*
    - *heavy machinery, motor vehicles, wood and wood products*
    - *livestock, perishable foods*
- National system
  - waterways
    - *inland rivers and canals, coastal waterways*
    - *St. Lawrence Seaway*
  - lakes
    - *Great Lake system*
  - oceans
  - ports


Water and Pipeline
• Pipeline transportation
– vital to meeting energy needs
– 214,000 operating miles in U.S.
– transports 21% of all intercity freight
– safest form of overland transportation
• Products
– crude oil, petroleum products
– natural gas
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Slide 14 - Water and Pipeline

- Pipeline transportation
  - vital to meeting energy needs
  - 214,000 operating miles in U.S.
  - transports 21% of all intercity freight
    - *transport almost 50% of ton-miles of crude oil domestically*
    - *move 56% of total petroleum products*
  - safest form of overland transportation
    - *both environmentally and in terms of human safety*
- Products
  - crude oil
  - petroleum products
    - *50 different grades of refined products including gasoline, kerosene, diesel fuels, etc.*
  - natural gas

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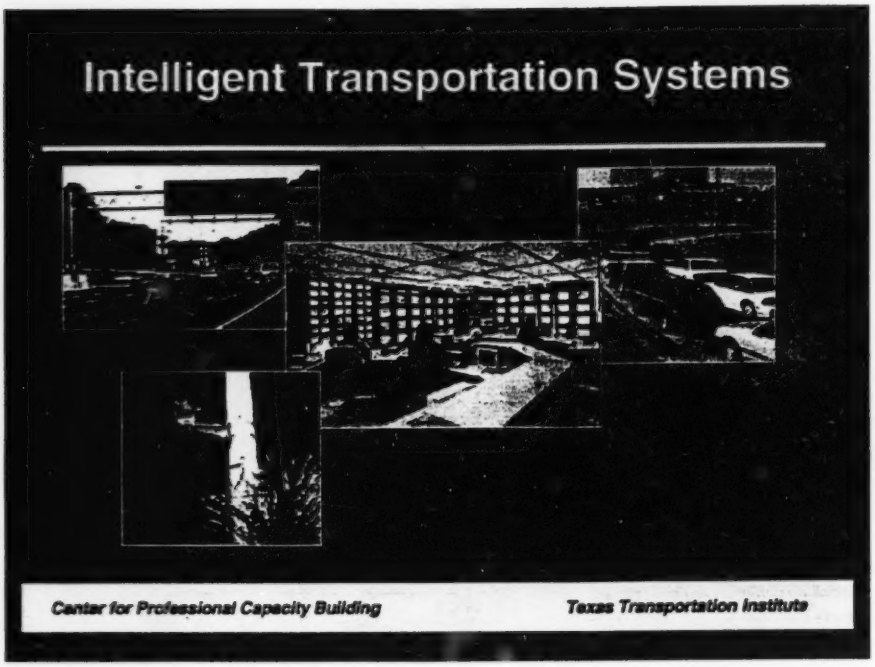

Slide 15 - Intelligent Transportation Systems

Use this as a background slide for the group participation.

•This will provide awareness of ITS.
•You will not be ITS experts.
•You will obtain a better understanding of the U.S. Department of Transportation's mission of "operations and management" of the existing and future transportation systems.
•ITS is a part of the changing world of new technology - the world of transportation in the "Information Age," an age of which we are all a part.
•ITS program is a joint highway, public transportation, and safety ITS program.
You will learn about potential career paths in ITS.

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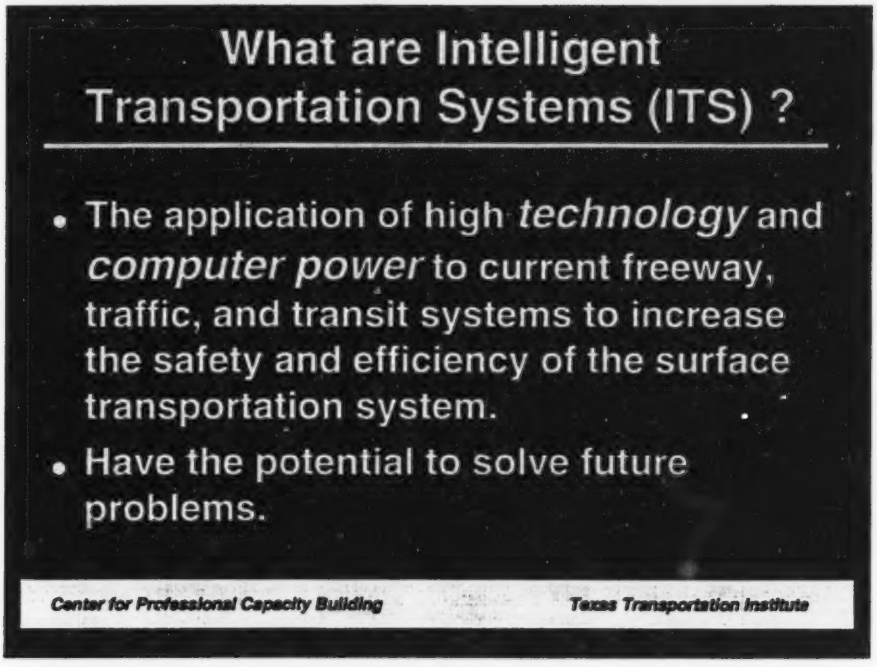
What are Intelligent Transportation Systems (ITS) ?
• The application of high technology and computer power to current freeway, traffic, and transit systems to increase the safety and efficiency of the surface transportation system.
• Have the potential to solve future problems.
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Slide16 - What are Intelligent Transportation Systems (ITS)?

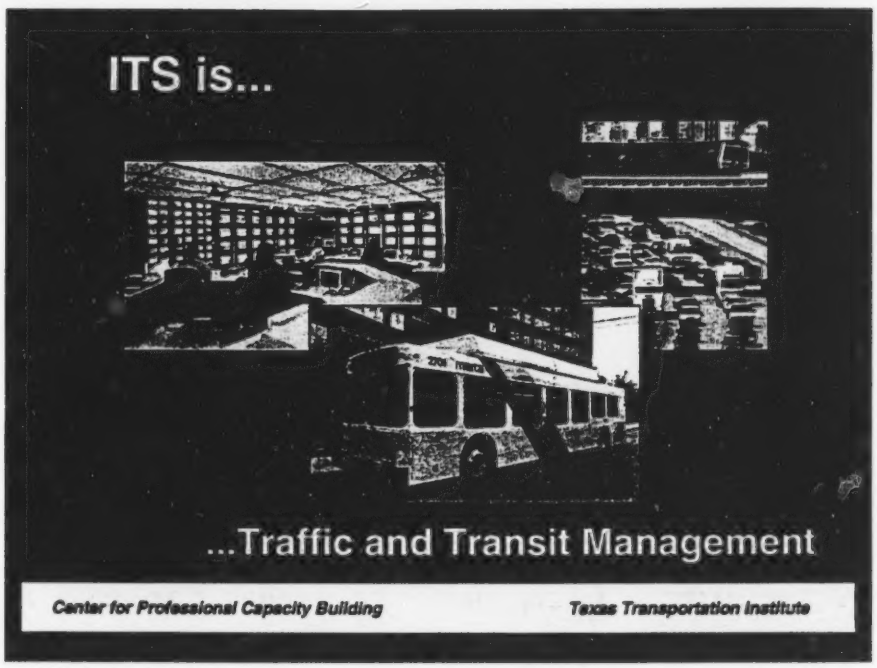
•The application of high ***technology*** and ***computer power*** to current freeway, traffic, and transit systems to increase the safety and efficiency of the surface transportation system.
•Have the potential to solve future problems.
•Various components and products in use in everyday life can be applied to the transportation arena (bring some of these "toys" if you have them).

- *-computers -CCTV -cellular phones*
- *-loop detectors -modems -GPS bus antenna*
- *-E-mail -RWIS -World Wide Web*
- *-electronic fare card -pagers*

•With ITS, as with other areas of life, lots of information is exchanged, communicated, and managed.
•The private sector (rail, trucking, air, water) are well ahead in these applications.

- *-Traveler information services*
- *-Ford and GM Mayday systems*

•How does technology affect your life daily? Aside from transportation.

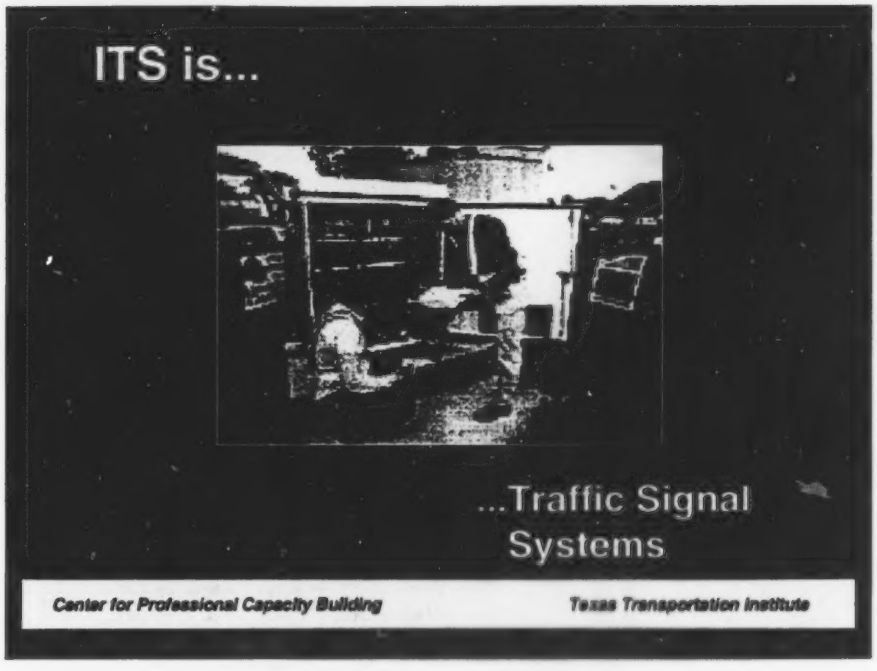


Slide 17 - ITS is . . .

Traffic and Transit Management

ITS can assist us in operating our facilities as safely and efficiently as possible, especially as new construction becomes more scarce.

Picture
Management/Operations Center



Slide 18 - ITS is . . .

Traffic Signal Systems

Advanced traffic signal systems can minimize the stop and go traffic flow. They are especially helpful during incident management or during special events.

Picture
Traffic signal control cabinet. Can change signal timing here. With computerized signal system and a link to your office and/or home, you can change it from those locations, too.

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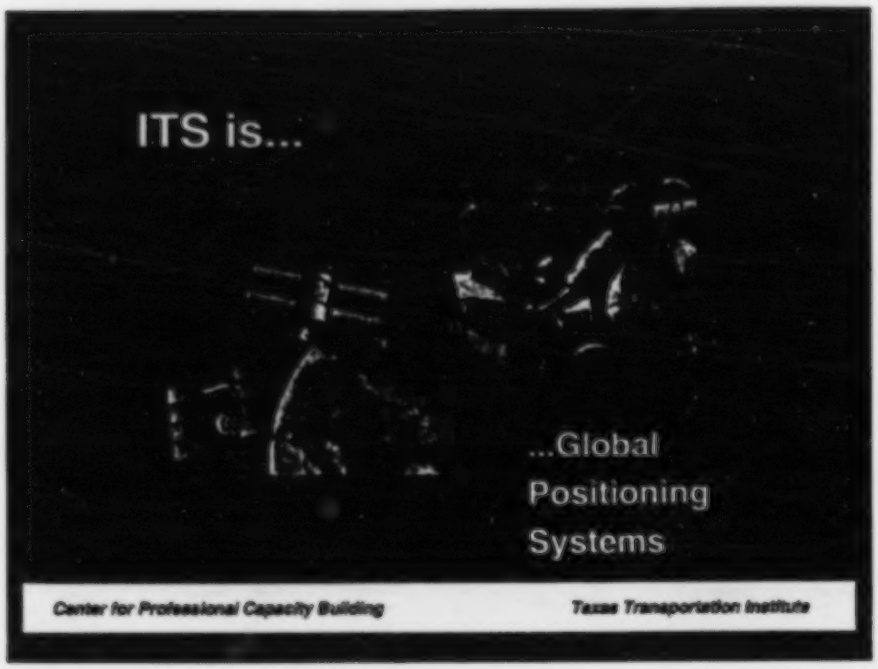

Slide 19 - ITS is . . .

Global Positioning Systems

Useful for tracking car, bus, truck, train, and ferry location.

Pictures (left to right)
1) Satellites used for determining positions of objects (a good example is transit operators locating their buses).
2) Using global positioning systems for surveying instead of traditional equipment-more accurate and precise.

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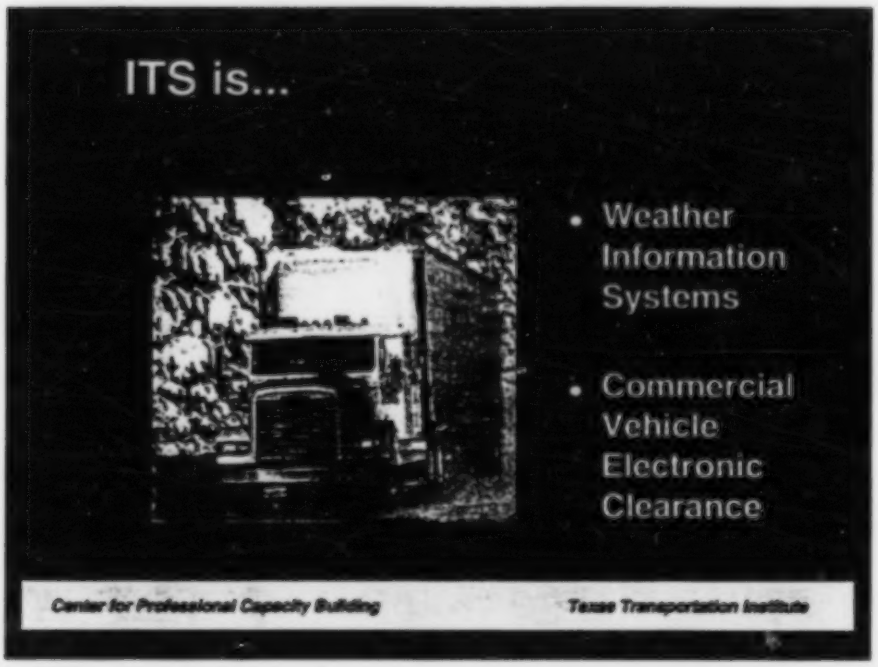


Slide 20 - ITS is . . .

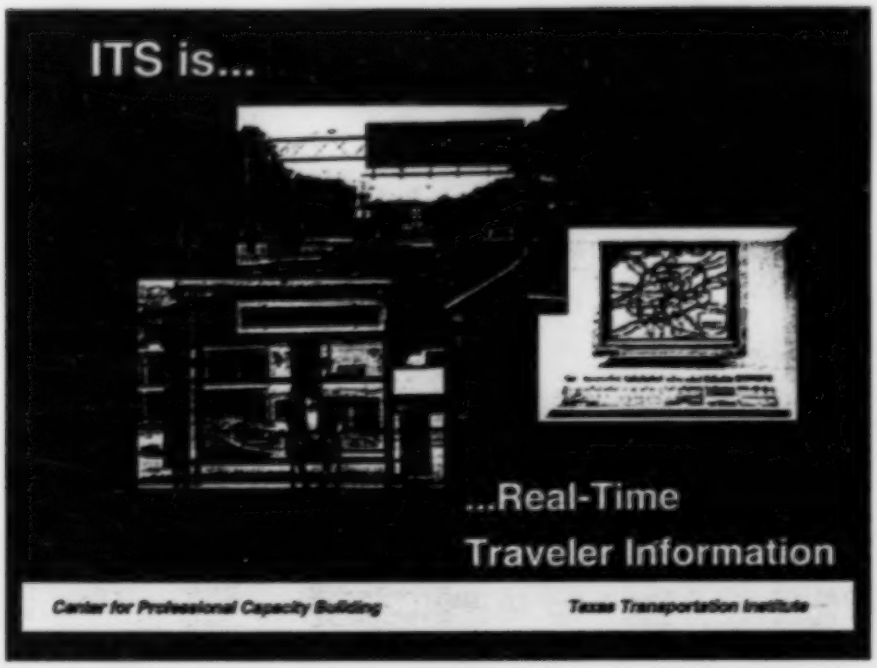
Weather Information Systems

ITS can provide information such as:

–Are the roads flooded?
–Are the roads covered with snow?
–Is visibility reduced because of heavy fog?

Commercial Vehicle Electronic Clearance

With this system, trucks don't have to stop numerous times on a single trip to be checked.



Slide 21 - ITS is . . .

Real-Time Traveler Information:

ITS lets travelers, businesses, and commercial carriers know what to expect so that the trip time can be precisely predicted.

Pictures (left to right)
1)Real-time display of bus information at a bus stop (Atlanta)
2)Dynamic Message Sign (message reads: COURTLAND ST EXIT MOVING SLOWLY USE ALTERNATE EXIT)
3)Traveler information on the Internet

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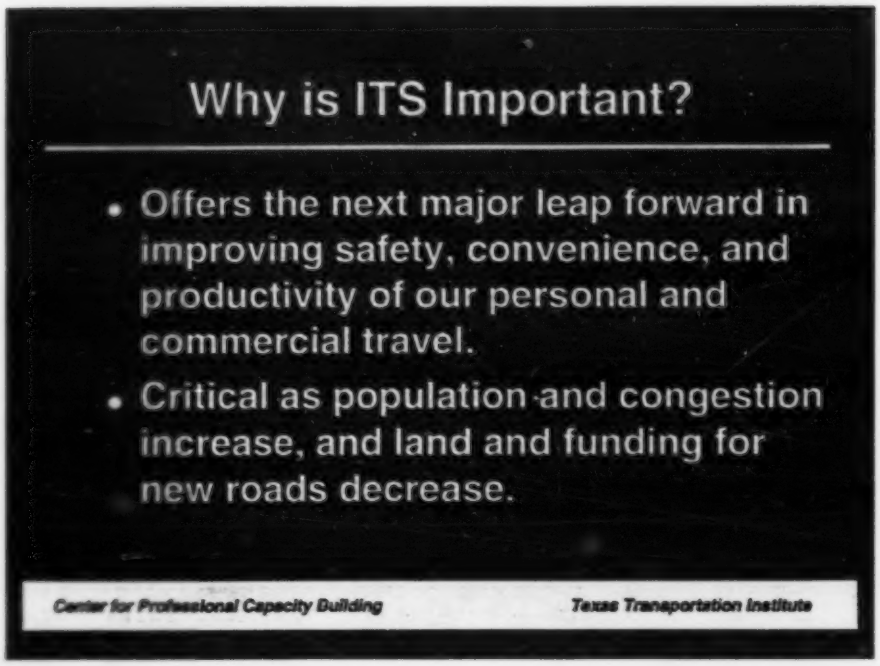
Why is ITS Important?
• Offers the next major leap forward in improving safety, convenience, and productivity of our personal and commercial travel.
• Critical as population and congestion increase, and land and funding for new roads decrease.
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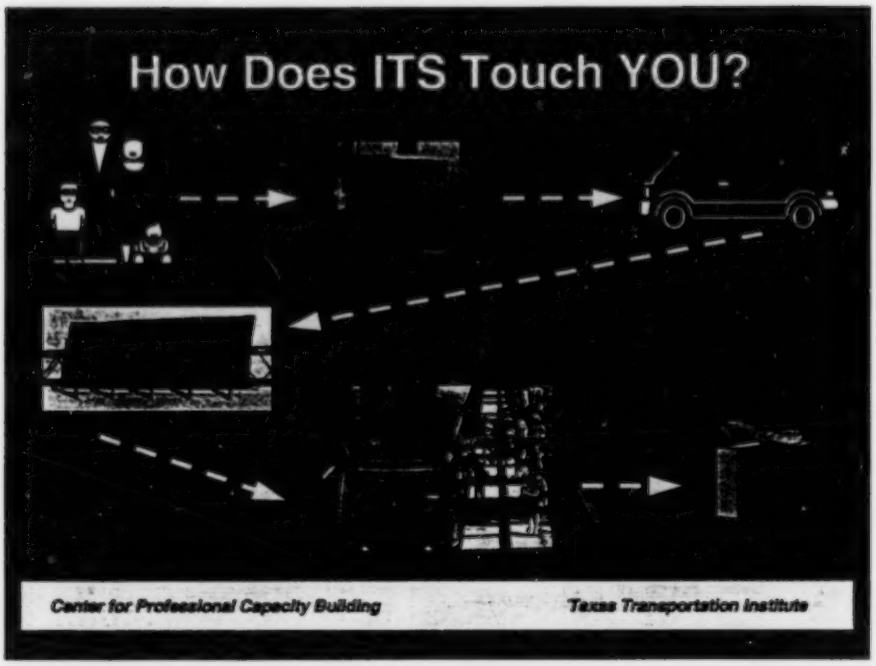
Slide 22 - Why is ITS Important?

•Offers the next major leap forward in improving safety, convenience, and productivity of our personal and commercial travel.
•Critical as population and congestion increase, and land and funding for new roads decrease.

It is time for a paradigm shift. We have to think in terms of operating what we already have more efficiently rather than building our way out of congestion.



Slide 23 - How Does ITS Touch YOU?

It is Sunday and you are going on a family outing to your grandmother's house in the next county. Mom and Dad ask you to help plan the trip. Your task is to keep the family on schedule, and help the family to arrive safely and on time.

"How's the traffic?" Dad asks. You go to the television and check the local cable traffic station. You report, "Dad the traffic flow is normal now, but the weather station is calling for drizzle. We should leave soon."

First you must travel the highway to the transit station, then the family will take the commuter rail, about a 45-minute ride, to your grandmother's house. You are running just a little late. You push the family along, ushering your brother and sister to the car. Remember your task is to keep the family on schedule.

Your family is on the way. As the car turns onto the highway the rain is beginning to fall and you hear a siren. A police car whizzes by, followed by a tow truck. Two miles ahead of you, a car has a flat tire. Traffic is stopped.

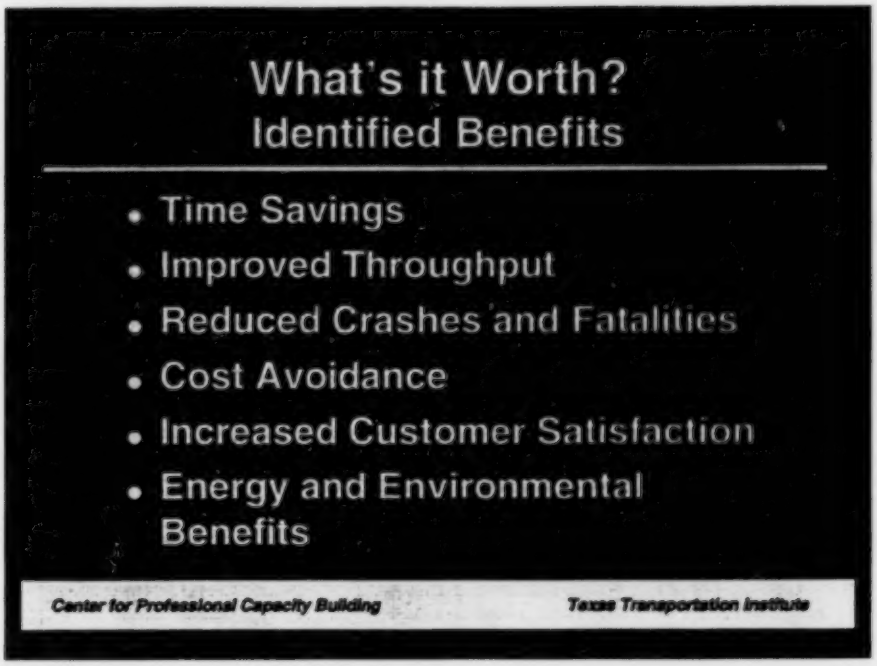
In class you learned that traffic centers monitor freeways and major roads, using video systems. You ask your Mom to turn on the radio, and say, "Dad, listen for the traffic report, and I will watch for the typed message on the overhead highway sign."

As you speak, a specialist monitoring the freeway from a traffic center notifies the police, a tow truck driver, and a traffic reporter. The police call for an ambulance in case of an emergency. The electronic highway messaging sign flashes. You say, "Look Dad, the sign advises taking another route."

He takes the advice and arrives at the transit station right at boarding time. You run to the travel kiosk in the lobby to check the arrival time, and shout to your family, "We have one minute to make the train, or we can wait for one hour." You make a mad dash -- WHAT ABOUT YOUR TICKETS? No need to stop to buy tickets, you all have electronic fare cards. Do you make it? Yes, safely and in time for your grandmother's surprise birthday party.

And, as a bonus, when your mother decides the family will stay the weekend, what is your task? You borrow your Uncle's laptop computer and surf the Internet for hotels, historical sites, festivals, theme parks, a rental car-and travel schedules back home on Monday. Now you understand how ITS technology works for you today.

This is a real life example of how Intelligent Transportation Systems benefits us all. Transportation professionals are developing systems to make all transportation safer and more efficient. Research, tests, and technology are contributing to better transportation for all Americans.



Slide 24 - What's it Worth? Identified Benefits

These are 6 good measures for the Federal Government Performance Results Act:

•**Time** Savings

-Faster to respond to incidents from CCTV; Select fastest mode from advanced traveler information

-Electronic toll facilities reduce stopping delays; Electronic clearance for CVO

-Inform (Long Island): estimates of savings as high as 1900 vehicle-hours for peak period incident

•Improved Throughput

-Seattle freeway management: traffic up 10% to 100% along I-5

-Doing what we can to keep traffic off of residential streets; Improve transit vehicle on-time performance

-Helping highway throughput due to advanced traveler info decision.

•Reduced Crashes and Fatalities

-Minneapolis: 27% reduction in annual accident rates on I-35W

-Faster incident notification time means a reduction in fatalities

-With Mayday systems in rural areas; with cellular phones, urban areas

-Blind spot detection sensors - on school buses

•Cost Avoidance

-NJ Transit: annual reduction of $2.7 m in cash handling with electronic fare

-Trucking deliveries up 10-20% with computer assisted dispatching

-Trucking also save money by saving time thru electronic clearance

•Increased Customer Satisfaction

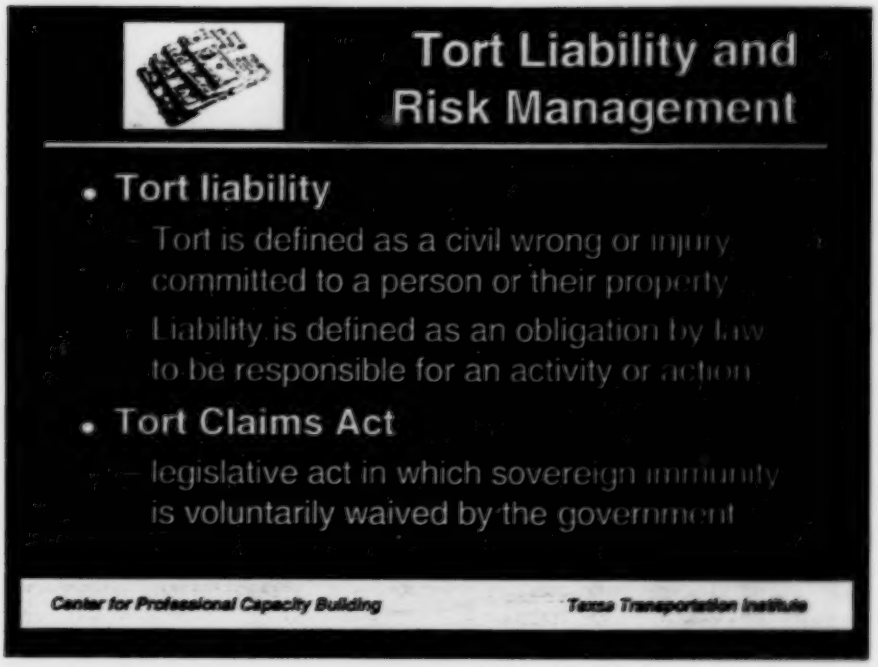
-Improve on-time performance for transit vehicles/customers

-Smart Card - interoperability; can use one card for many systems

-Express bus routes (Phoenix, AZ) report 90% of fares paid by bus pass cards

•Energy and Environmental Benefits

-Improved efficiency results in reduced emissions and fuel savings


Tort Liability and Risk Management
• Tort liability
– Tort is defined as a civil wrong or injury committed to a person or their property
– Liability is defined as an obligation by law to be responsible for an activity or action
• Tort Claims Act
– legislative act in which sovereign immunity is voluntarily waived by the government
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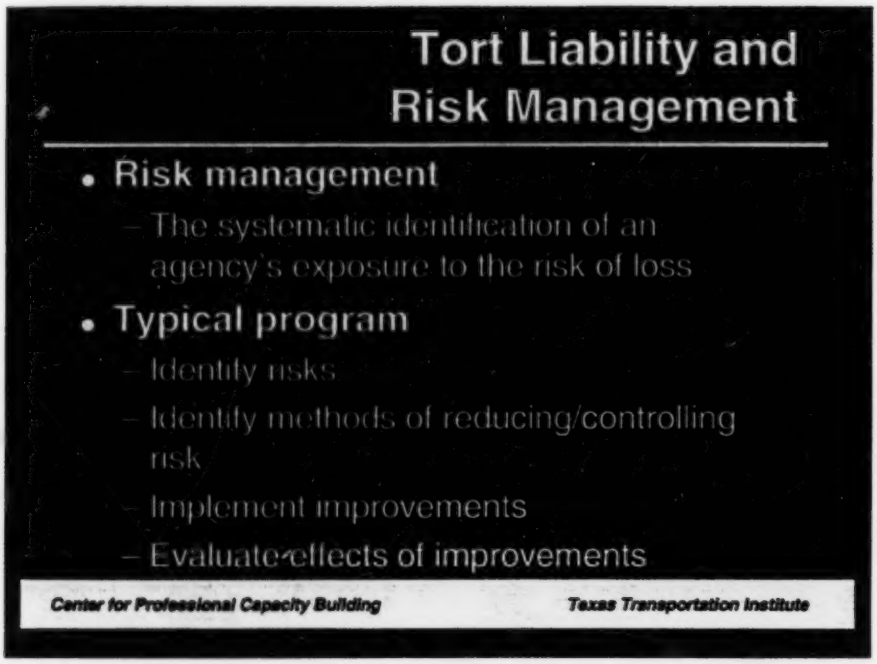
Slide 25 - Tort Liability and Risk Management

- Tort liability
  - Tort is defined as a civil wrong or injury committed to a person or their property
  - Liability is defined as an obligation by law to be responsible for an activity or action
- Tort Claims Act
  - legislative act in which sovereign immunity is voluntarily waived by the government
  - limitations on damages help to control expenses; general public tends to go for the deep pocket in a lawsuit
- Tort Claims Case
- Plaintiff must prove 5 things:
  - the defendant had a duty to the injured
  - there was a breach of that duty
  - the breach of duty was the proximate cause of the injury
  - there was a minimum (or no) contributory negligence on the part of the plaintiff
  - there must have been an injury
- Defendant
  - Did a potential hazard exist?
  - Was a defect the cause of the accident?
- Did the defendant have knowledge of the hazardous condition?


Tort Liability and Risk Management
• Risk management
– The systematic identification of an agency's exposure to the risk of loss
• Typical program
– Identify risks
– Identify methods of reducing/controlling risk
– Implement improvements
– Evaluate effects of improvements
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Slide 26 - Tort Liability and Risk Management

- Risk management
  - The systematic identification of an agency's exposure to the risk of loss
  - Making decisions on the best methods for handling these exposures to minimize losses
- Risk management methods
  - Risk Finance (taxes, fund)
  - Risk Control (prevention, severity)
  - Risk Sharing
- Typical program
  - Identify risks
  - Identify methods of reducing/controlling risk
  - Implement improvements
- Evaluate effects of improvements

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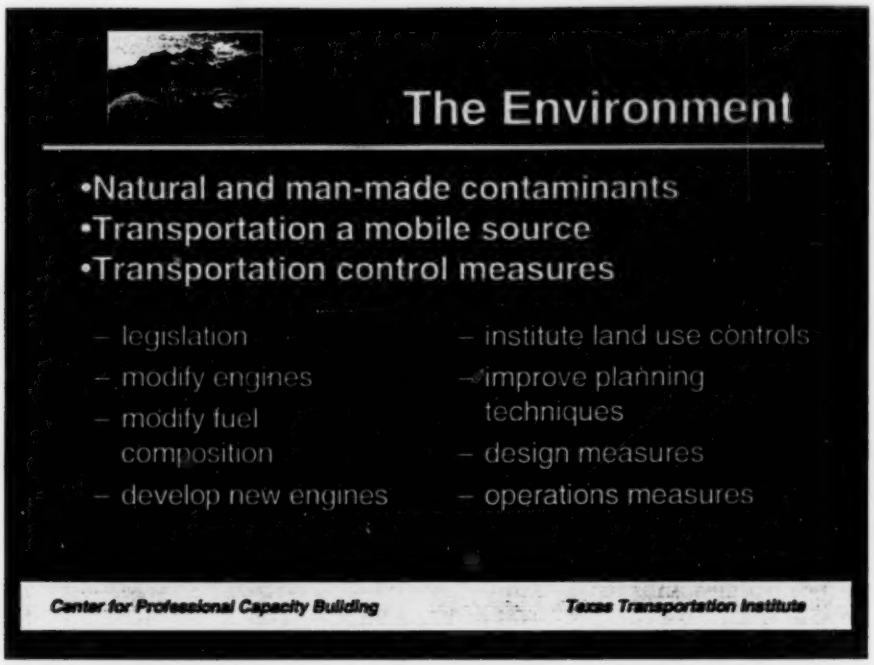

Slide 27 - The Environment

•Natural and man-made contaminants

- *•natural - dust, smoke, pollen, wind borne salts*
- *•man-made - oxides of carbon, sulfur, nitrogen, hydrocarbons, ozone, chloroflourocarbons, particulate matter*

•Transportation a mobile source

- *•carbon monoxide, oxides of sulfur and nitrogen, hydrocarbons, ozone*

•Transportation control measures

- •legislation - *1955 Air Pollution Act, 1965 Motor Vehicle Air Pollution Control Act, Air Quality Act of 1970, 1990 CAAA*
- •modify engines - *smaller, run on leaner fuel/air mixtures, changes to shape of combustion chamber, reduced engine compression*
- •modify fuel composition - *methanol, liquid and compressed natural gas*
- •develop new engines - *rotary, battery/power plant*
- •institute land use controls - *increase/decrease density*
- •improve planning techniques - *consider the effects of use of other modes*
- •design measures - *coordination of signals, ramp metering, HOV lanes*
- •operations measures - *flat grades, elevated/depressed highway sections*

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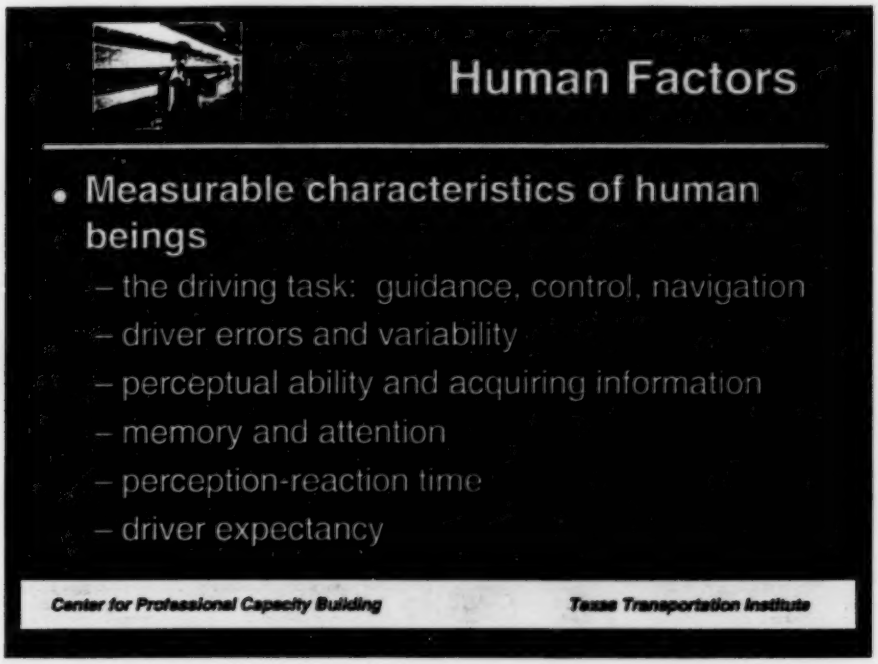
Human Factors
• Measurable characteristics of human beings
– the driving task: guidance, control, navigation
– driver errors and variability
– perceptual ability and acquiring information
– memory and attention
– perception-reaction time
– driver expectancy
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Slide 28 - Human Factors

•Measurable characteristics of human beings
- •the driving task: guidance, control, navigation
  - *•observe and monitor events related to the roadway and traffic, process information, make decisions, take actions*
- •driver errors and variability
  - *•drivers are continually making errors and making adjustments to compensate for them*
  - *•no "design" driver; characteristics vary by time of day, experience, skills, maturity, emotional state, etc.*
- •perceptual ability and acquiring information
  - *•primary means by which the driver acquires information is by sight*
  - *•peripheral vision (120-160 degrees), cone of satisfactory vision (20 degrees), cone of clear vision (10 degrees), cone of best vision (3 degrees)*
- •memory and attention
  - *•short-term (1-5 secs), intermediate (1-2 min), long-term (months/years)*
  - *•attention - driving is a vigilance task*
- •perception-reaction time - *need more time when situation is unfamiliar, several possible choices, problem posed is complex, driver is not at his/her best*
- •driver expectancy - *when expectancies met or reinforced, aid in driving task; when violated, drivers need more time to respond and performance is poorer*

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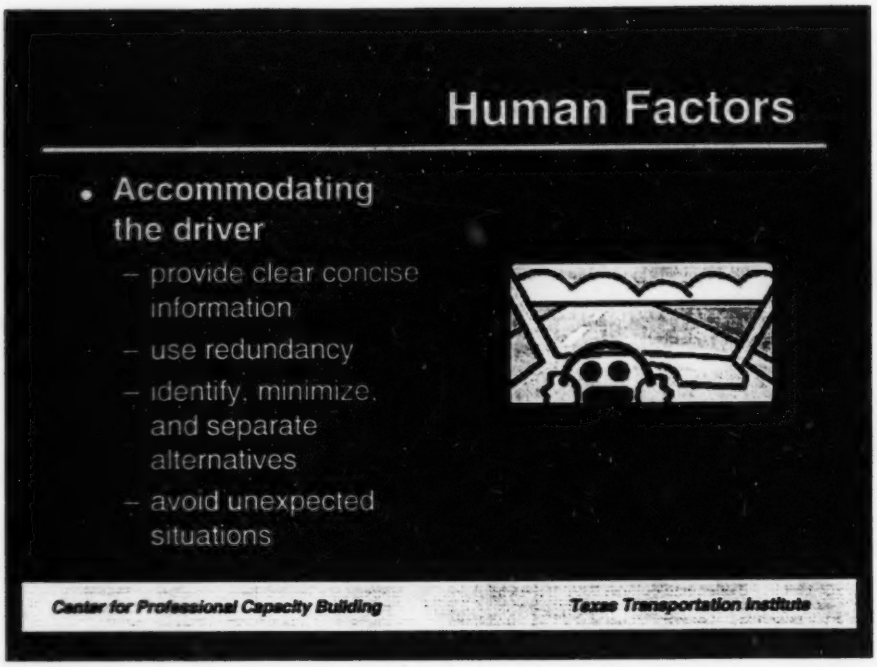
Human Factors
• Accommodating the driver
– provide clear concise information
– use redundancy
– identify, minimize, and separate alternatives
– avoid unexpected situations
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Slide 29 - Human Factors

•Accommodating the driver
- •provide clear concise information
- •use redundancy as a means of insuring that critical information is received
- •identify, minimize, and separate alternatives to help drivers make proper choices
- •avoid unexpected situations, which are a prime source of driver confusion and poor driver performance

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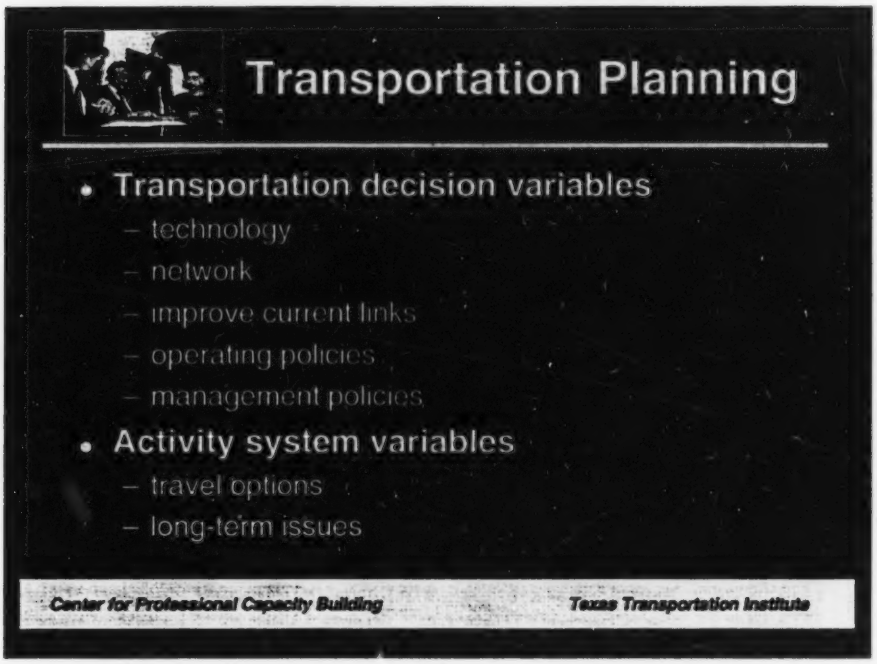

Slide 30 - Transportation Planning

- **Transportation decision variables - What causes a change?**
  - Technology
    - *basic - propulsion systems/fuels; service - schedules/demand-responsive systems; better vehicles; better roads*
  - network
    - *increased accessibility; new links; new ports; etc.*
  - improve current links
    - *increase capacity; improve signal timing; HOV; truck climbing lane; etc.*
  - operating policies
    - *tolls; financing (public vs. private)*
  - management policies
    - *who has control/responsibility for the roads*
- **Activity system variables**
  - travel options
    - *decision to make a trip; when to make a trip; how to make a trip; where to go; how often to make a trip; combinations of trips/trip chaining*
  - long-term issues
    - *changes in business/recreating centers; changes in population and business activities*

Transportation Planning
• Mechanisms for achieving land use policy goals and objectives
– planning / development regulations
– zoning
– eminent domain
– contract agreements
– tax structure
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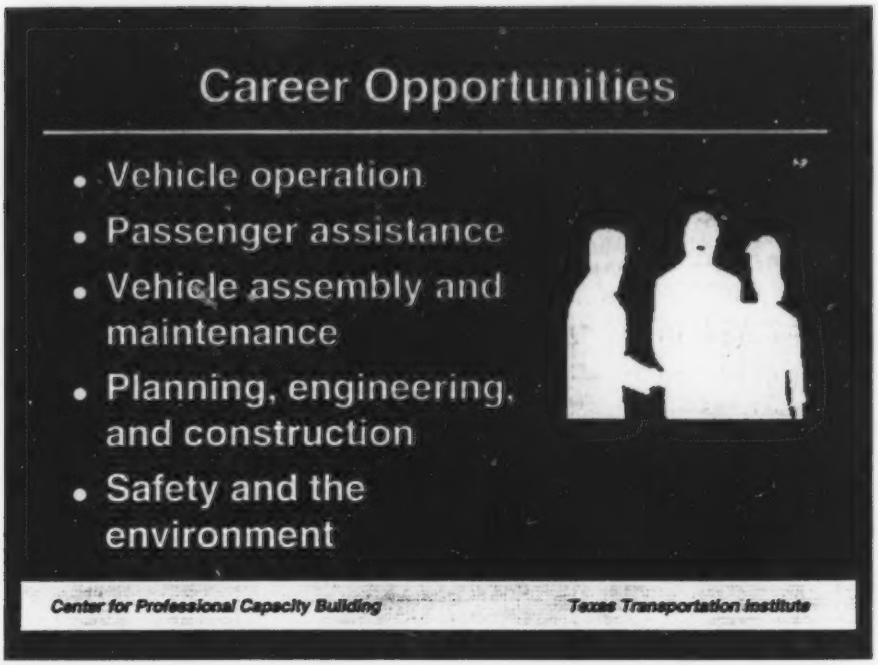
Slide 31 - Transportation Planning

- Mechanisms for achieving land use policy goals and objectives
  - planning / development regulations
    - *parking, sign ordinance, subdivision regulation, etc.*
  - zoning
  - eminent domain
    - *take land: fire, school, transportation*
  - contract agreements
    - *deed restrictions*
  - tax structure
  - impact fees



Slide 32 - Career Opportunities

- Vehicle operation
  - *truck and bus drivers, subway operators, taxi drivers and chauffeurs, locomotive engineers and railroad conductors, aircraft pilots, ship captains and pilots, etc.*
- Passenger assistance
  - *travel agents, flight attendants, reservation and transportation ticket agents and travel clerks*
- Vehicle assembly and maintenance
  - *assemblers, automotive mechanics, diesel mechanics, aircraft mechanics, shipbuilders*
- Planning, engineering, and construction
  - *urban and regional planners, engineers, engineering technicians, logistics managers, construction trades*
- Safety and the environment
  - *air traffic controllers, vessel traffic control specialists, safety inspectors, environmentalists*

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Slide 33 - ITS Opportunities: Specialists

•Aerospace Engineers
•Environmentalists
•Systems Engineers
•Computer Scientists
•Communications Engineers

Each of these specialists have a role to play in ITS, as evident by the information and technologies discussed in this session.
Other fields of study for careers in ITS are:

Economics
Political Science
Modeling / Simulation
Logistics
Statistics
Anthropomorphics
Cognition
Marketing

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Slide 34 - Career Opportunities: Required Skills

•Engineering
•Electronics
•Communications
•Systems Integration

Together, working as a team, individuals with these skills are necessary to plan, design, build, operate, and maintain the infrastructure being put in place today. These skills are critical to ensuring mobility in the next century.

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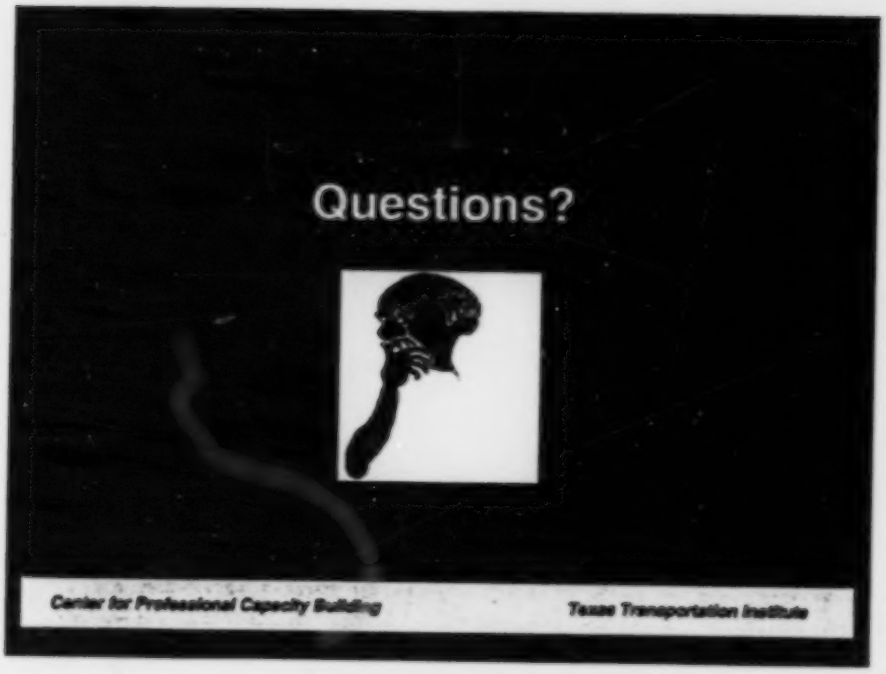

Slide 35 - Questions?

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APPENDIX B: PROJECT FEEDBACK FORMS

Transportation Engineering Education and Outreach Program
Designed for the Collegiate Level

TTI Project No. 472840-29

AFTER EVENT REPORT

Name _____ **Date of Event** _____

Institution _____ **Contact** _____

Address _____ **Phone** _____

_____ **E-Mail** _____

_____

Course _____

Level of Majority of Students **Fr** **So** **Jr** **Sr** **Gr**

No. of Students _____

Nature of Event _____

Briefly discuss how the event was received.

_____

_____

_____

_____

_____

After event, please submit this form to:

Beverly T. Kuhn
Texas Transportation Institute
7715 Chevy Chase Drive, Suite 4.160
Austin, TX 78752
Phone: (512) 467-0946
Fax: (512) 467-8971
E-Mail: B-Kuhn@tamu.edu

Transportation Engineering Education and Outreach Program
Designed for the Collegiate Level

TTI Project No. 472840-29
EVENT FEEDBACK REPORT

Name _____ **Date of Event** _____

Institution _____ **Phone** _____

Address _____ **Fax** _____

_____ **E-Mail** _____

_____

Course _____

Level of Majority of Students **Fr** **So** **Jr** **Sr** **Gr** **No. of Students** _____

Nature of Event _____

TTI Contact _____

Nature of Event _____

Did you find the event interesting and informative for your students? ☐ Yes ☐ No

Was the information presented at the appropriate knowledge level for your students? ☐ Yes ☐ No

Was the TTI Contact helpful in scheduling and coordinating the event? ☐ Yes ☐ No

Would you like your class to participate in this event again? ☐ Yes ☐ No

Please provide comments and suggestions that will help us improve this event and list any other events you might like to see presented in the future.

_____

_____

_____

After event, please submit this form to:

Beverly T. Kuhn
Texas Transportation Institute
7715 Chevy Chase Drive, Suite 4.160
Austin, TX 78752

Phone: (512) 467-0946
Fax: (512) 467-8971
E-Mail: B-Kuhn@tamu.edu